

**WHAT IS CLAIMED IS:**

1. A chemical array reader, comprising:
  - a) a holder to mount an array;
  - b) a calibration member;
  - c) a light system to illuminate the calibration member or mounted array when either is at a reading position;
  - d) a carriage which alternately positions the mounted array and calibration member into the reading position;
  - e) a detection system having a focal plane, to detect light from one or more regions of the calibration member and from different regions across the array emitted in response to the illumination, when either is in the reading position, and which generates a resulting signal for each of the one or more regions of the calibration member and for each of the regions across the array;
  - f) an adjuster to adjust the position of the calibration member, when in the reading position, relative to the focal plane, such that a position of the focal plane can be determined from the resulting detection system signal;
  - g) an autofocus system which senses and reduces offset between the different regions of the array, when in the reading position, and the determined focal plane position.
2. A chemical array reader according to claim 1 additionally comprising a processor which determines the focal plane position from the light detected at various adjustments of the calibration member.
3. A chemical array reader according to claim 2 wherein the focal position is determined based on a variation in detected light amplitude from the same region of the calibration member or from multiple regions of the calibration member from which the detected light is the same when at the focal plane, which variation results from the adjustment of the calibration member relative to the focal plane.
4. A chemical array reader according to claim 3 wherein the emitted light is the same from each of detected regions of the calibration member.

5. A chemical array reader according to claim 2 wherein the processor controls the adjuster to vary the adjustment.
6. A chemical array reader according to claim 1 wherein the adjuster simultaneously adjusts the position of the calibration member and mounted array relative to the focal plane.
7. A chemical array reader according to claim 2 wherein the processor additionally calibrates a sensitivity of the detection system from detection system signals generated from the calibration member.
8. A chemical array reader according to claim 1 wherein the detection system detects light at multiple wavelengths from the calibration member or array, when either is at the reading position, and generates a resulting signal for each of the multiple detected wavelengths for the one or more regions of the calibration member and for each of the regions across the array.
9. A chemical array reader according to claim 7 wherein:  
the detection system detects light at multiple wavelengths from the calibration member or array, when either is at the reading position, and generates a resulting signal for each of multiple detected wavelengths corresponding to each of the one or more regions of the calibration member and the regions across the array; and  
the processor calibrates a sensitivity of the detection system at each of multiple detected wavelengths from the detection system signal generated from the calibration member at that wavelength.
10. A chemical array reader according to claim 3 wherein the light system illuminates a region and the detection system detects from a region, and the reader additionally comprises a scan system to simultaneously scan the illuminated and detected regions across the different regions of the array when at the reading position.

11. A chemical array reader according to claim 10 wherein the scan system additionally scans the illuminated and detected regions across different regions of the calibration member when at the reading position, such that the detection system generates a resulting signal for each of the different regions across the calibration member.

12. A chemical array reader according to claim 3 wherein the autofocus system reduces the offset by adjusting the relative position of the array and determined position of the focal plane using the adjuster.

13. A chemical array reader according to claim 12 wherein the autofocus system includes a detector to detect the offset as an offset signal, and includes a processor which receives the offset signal and controls the adjuster to reduce the offset.

14. A chemical array reader according to claim 12 additionally comprising a processor which uses multiple resulting signals from different regions on the calibration member to determine the focal plane position.

15. A method using a chemical array reader having:

- i) a holder to mount an array and hold the array at a reading position;
- ii) a light system to illuminate a mounted array when at a reading position;
- iii) a detection system having a focal plane, to detect light from different regions across the array emitted in response to the illumination, when at the reading position, and which generates a resulting signal for each of the regions across the array; and
- iv) an autofocus system which detects and reduces offset between the different regions of an array at the reading position and a determined position of the focal plane;

the method comprising:

- a) positioning a calibration member at the reading position so as to receive illumination from the light system and emit light in response thereto, which emitted light is detected by the detection system to generate a resulting calibration signal;
- b) adjusting a position of the calibration member, when in the reading position, relative to the focal plane;

- c) determining the position of the focal plane from the light detected at various adjustments; and
- d) calibrating a sensitivity of the detection system from the detection system signals generated from the calibration member.

16. A method according to claim 15 wherein the focal position is determined based on a variation in detected light amplitude from the same region of the calibration member or from multiple regions of the calibration member from which the detected light is the same when at the focal plane, which variation results from the adjustment of the calibration member relative to the focal plane.

17. A chemical array reader according to claim 16 wherein the emitted light is the same from each of the detected regions of the calibration member.

18. A method according to claim 15 wherein the position of the calibration member and the holder, relative to the focal plane, are simultaneously adjusted.

19. A method according to claim 15 wherein the detection system detects light at multiple wavelengths from the calibration member or array, when either is at the reading position, and generates a resulting signal for each of multiple detected wavelengths for a region of the calibration member and each of the regions across the array, and wherein the method comprises positioning a calibration member in (a) which emits light at the multiple wavelengths in response to illumination from the light system.

20. A method according to claim 15 wherein the light system illuminates a region and the detection system detects from a region, and the reader additionally comprises a scan system which simultaneously scans the illuminated and detected regions across the different regions of the array when at the reading position.

21. A method according to claim 20 wherein the scan system additionally scans the illuminated and detected regions across different regions of the calibration member when at the reading position, such that the detection system generates resulting signals for each of the

different regions across the calibration member, which are used to determine the focal plane position.

22. A method of using a chemical array reader of claim 1, comprising
- using the carriage to position the calibration member at the reading position so as to receive illumination from the light system and emit light in response thereto, which emitted light is detected by the detection system to generate a resulting calibration signal; and
  - determining the position of the focal plane from the calibration signal.
23. A method according to claim 22 additionally comprising adjusting a position of the calibration member, while in the reading position, relative to the focal plane, and determining the position of the focal plane from the detection system signals at various adjustments.
24. A method according to claim 23 additionally comprising calibrating a sensitivity of the detection system from the detection system signals generated from the calibration member.
25. A method according to claim 23 wherein the detection system detects light at multiple wavelengths from the calibration member or the array, when the corresponding one is at the reading position, and generates a resulting signal for each of multiple detected wavelengths corresponding to a region of the calibration member and each of the regions across the array, and wherein the method comprises in (a), positioning a calibration member at the reading position which emits light at the multiple wavelengths in response to illumination from the light system.
26. A method according to claim 25 wherein a sensitivity of the detection system is calibrated at each of multiple detected wavelengths from the detection system signal generated from the calibration member at that wavelength.
27. A method according to claim 15, additionally comprising:

reading an array by positioning the array at the reading position such that the detection system detects light from different regions across the array emitted in response to the illumination, and generates a resulting signal for each of the regions across the array.

28. A method according to claim 27, additionally comprising forwarding data representing a result of the reading obtained by the method of claim 22.
29. A method according to claim 27 wherein the data is communicated to a remote location.
30. A method comprising receiving data representing a result of a reading obtained by the method of claim 27.
31. A computer program product for use with a chemical array reader of having:
- i) a holder to mount an array and hold the array at a reading position;
  - ii) a light system to illuminate a calibration member or mounted array when either is at a reading position;
  - iii) a detection system having a focal plane, to receive light from a region of the calibration member and from different regions across the array emitted in response to the illumination, when either is in the reading position, and which generates a resulting signal for a region of the calibration member and for each of the regions across the array;
  - iv) an adjuster to adjust the position of the calibration member, when in the reading position, relative to the focal plane, such that a position of the focal plane can be determined from the resulting detection system signal;
  - iv) an autofocus system which detects and reduces offset between the different regions of an array at the reading position and a determined position of the focal plane; and
  - v) a processor communicating with the autofocus and detection systems;
- the computer program product comprising a computer readable storage medium having a computer program stored thereon which, when loaded into the processor, executes the method of:
- a) adjusting the position of the calibration member relative to the focal plane;

b) determining the focal plane position from the resulting detection system signals at various adjustments of the calibration member.

32. A computer program product according to claim 31 which additionally calibrates a sensitivity of the detection system from the detection system signals generated from the calibration member.

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